

Title: Exploring the impact of Bi₂O₃ particle size on the efficacy of dimethylpolysiloxane for medical gamma/X-rays shielding applications

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Abstract: In this work, the effect of the particle size range on dimethylpolysiloxane (DMPS) on the attenuation properties was investigated. The control sample was prepared consisting of 50% DMPS+50% Bi₂O₃-MPs and referred (DMPS-Bi₂O₃)50m. Microparticles (MPs) were gradually replaced by Nanoparticles (NPs) to fabricate five samples coded by (DMPS-Bi₂O₃)40m10n, (DMPS-Bi₂O₃)30m20n, (DMPS-Bi₂O₃)25m25n, (DMPS-Bi₂O₃)20m30n, (DMPS-Bi₂O₃)10m40n, and (DMPS-Bi₂O₃)50n. The LAC “Linear attenuation coefficient” was determined at different energies including low and high energies for all prepared composites using an experimental gamma ray measurements and acquisition system. The HPGe detector and various point sources (60Co, 137Cs and 241Am) was used in the experimental technique. The LAC of control sample was evaluated by XCOM-software and compared to the experimental values to verify the accuracy of the experimental results. The other attenuator parameters (Half (HVL) and Tenth (TVL) value layer and mean free path (MFP) as well as Radiation shielding efficiency (RSE)) have been calculated. The highest LAC of the prepared polymer composites was (DMPS-Bi₂O₃)25m25n while the lowest LAC observed for control sample (DMPS-Bi₂O₃)50m at all discussed energies. The HVL of (DMPS-Bi₂O₃)25m25n < (DMPS-Bi₂O₃)20m30n < (DMPS-Bi₂O₃)30m20n < (DMPS-Bi₂O₃)10m40n < (DMPS-Bi₂O₃)40m10n < (DMPS-Bi₂O₃)50n < (DMPS-Bi₂O₃)50m at all discussed experimental energies.

Keywords: Dimethylpolysiloxane (DMPS), Bismuth oxide (Bi₂O₃), Microparticles (MPs), Nanoparticles (NPs), Polymer composites, Gamma ray attenuation, Linear attenuation coefficient (LAC)

DOI: <https://doi.org/10.1016/j.radphyschem.2024.111629>

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